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(54) Rinse and Treatment Liquid for Deep-hole Drilling Which Contains Solid Material

(57) The invention relates to a rinse and treatment liquid for deep-hole drilling which contains solid material for deep-hole drilling and treatment of porous and permeable layers, in particular of carbon-bearing beds and of underground carriers. The goal of the invention is to lower or at least to make feasible the expense of processing and treatment of drill holes. The technological objective of the invention is the development of a rinse and treatment liquid for deep-hole drilling which is distinguished by simple manufacture, permits sealing with small losses, can easily be reblocked, possesses a high sedimentation stability, and in particular can be used in layers bearing sulfate water. According to the invention the technological

objective is realized by the rinse and tr atment liquid for deep-hole drilling consisting of a suspension of the most finely grained NaCl in a $MgCl_2$ solution and containing a recrystallization inhibitor.

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Claims:

1. Rinse and treatment liquid for deep-hole drilling which contains solid material containing viscosity-increasing polymers characterized by the fact that the rinse consists of a suspension of the most finely grained NaCl in a $MgCl_2$ solution and containing a recrystallization inhibitor.
2. Rinse and treatment liquid for deep-hole drilling which contains solid material according to claim 1 characterized by the fact that potassium hexacyanoferrate II, $K_4Fe(CN)_6$, is used as a recrystallization inhibitor.
3. Rinse and treatment liquid for deep-hole drilling which contains solid material according to claims 1 and 2 characterized by the fact that the recrystallization inhibitor is contained in a concentration determining the grain size distribution of the disperse NaCl.

Field of Use of the Invention

The invention relates to a rinse and treatment liquid for deep-hole drilling which contains solid material for deep-hole drilling and treatment of porous and permeable layers, in particular of hydrocarbon-bearing beds and of underground carriers.

Characteristics of Prior-art Practices

Rinse and treatment liquids for deep-hole drilling which contain solid material, among other things, should fulfill the following objectives, in particular in th area of carrier layers:

- The desired inflow of mobile carrier layer content into the drill hole must be blocked by a density of the liquid, to be chosen appropriately, in order to exclude complications, in the most serious case eruptions.
- The penetration of rinse and treatment liquids for deep-hole drilling which contain solid material, or their components, into the carrier layer must be largely minimized in order to avoid affecting the permeability of the layer or economically significant losses through the loss of liquid into the layer. Thus as full a blocking as possible must occur, which can be removed at any given point in time (reblocking).

The following rinse and treatment liquids for deep-hole drilling which contain solid material are known:

Clay Rinses - Penetrated clay particles however cannot be removed once again from the interior of the layer, a reblocking thus being impossible or hardly possible.

Chalk Rinses - Suspensions of chalk or chalk powder in clay rinses or polymer solutions. A reblocking is possible by subsequent, material-consuming and corrosion-intensive suctioning, where the success of reblocking can, in part, be strongly affected by insoluble chalk impurities.

Salt Solutions - Salt solutions free of solid particles exclude, among other things, permanent blockings by clogging of the layer by solid materials. As a consequence of absent sealing filter crusts the loss of the often expensive salt solutions must be addressed by a sharp increase in the viscosity of the salt solution or by preceding sealing measures (pumping in of a highly viscous sealing buffer of strongly swelling polymers).

Salt Suspensions in Saturated Salt Solutions - Dispersions of fine-grain salts in saturated salt solutions cause a blocking filter cake which can easily and completely be reblocked by the water or diluted salt solutions, thus offering significant advantages.

In the US Patent No. 4046 197 of September 6, 1977 suspensions of fine-grain water-soluble salts in saturated salt solutions of minimum density of 1.2 g/cm^3 are cited as

working and treatment liquids which, in sufficient concentration, can significantly increase the density of the salt solution.

As salt solutions of the salts NaCl, $CaCl_2$, $CaBr_2$, $Ca(NO_3)_2$, and ZnCl, individually or in mixtures are named, as dispersed fine-grain particles NaCl is especially specified, where 99.5% of the particles are to be <25µm. The fine-grain NaCl are obtained by special milling processes.

The suspensions of fine-grain NaCl in saturated NaCl solutions and in $CaCl_2$ solutions are individually claimed as an invention.

For this patent it is to be noted that rinses on the basis of NaCl in $CaCl_2$ solutions cannot be used in holes or probes whose layer water contains sulfate ions since otherwise gypsum $CaSO_4 \cdot 2H_2O$, which is very hard to dissolve, forms, which can lead thereby to permanent blocking. Dispersions of NaCl particles in saturated NaCl salt water are in fact stable against the effect of sulfate ions as a consequence of the low density of the saturated NaCl salt water of 1.2 g/cm^3 but increases in density of the suspension can only be set up to ca. 1.30 g/cm^3 if the viscosity is not to rise to unusably high levels.

The goal of the addition of fine-grain NaCl to the salt solutions is merely to achieve higher densities than those of the underlying salt solutions. No proof is given for the claim that 99.5% of the NaCl particles are less than 25 µm. Not cited are claims for the formation of a filter cake as dense as possible. Accordingly the grain size spectrum of the disperse NaCl particles must meet definite requirements. Possible limits, which however are in no way generally binding, are set by Akstinat and Stopka in Erdöl und Kohle [Petroleum and Coal] 38 (1985) March, Page 114 - 115 at 2 µm and 200 µm. The optimal grain size spectrum is defined in the individual case by the pore radius spectrum of the ground to be sealed. A dense filter cake is a prerequisite for an effective blocking with minimal loss of the rinse into the ground.

With regard to the effect of potassium ferrocyanide potassium hexacyanof rrate II, it is only specified in DE 1467 232 of March 20, 1969 that through its addition a stable undersaturation or oversaturation of NaCl solutions is achieved, for example, for the purpose of preventing the addition of salt-water carrying tubular lines.

Goal of the Invention

The invention has the goal of lowering the expense of processing (for example holes) and treatment of drill holes (probes) and making this type of treatment possible at all in carrier layers containing sulfate water, in particular at high layer fluid pressures.

Explanation of the Essence of the Invention

The technological objective of the invention is the development of a rinse and treatment liquid for deep-hole drilling which contains solid material which is distinguished by simple production, permits sealing (blocking) with low losses, can be easily removed once again by reblocking, has a high sedimentation stability, and can be used in particular in layers containing sulfate water where required densities of 1.32 g/cm^3 are of decisive importance.

According to the invention the objective is realized by the rinse and treatment liquid for deep-hole drilling which contains solid material consisting of a suspension of the most finely grained sodium chloride in a magnesium chloride solution which contains viscosity-increasing polymers and small amounts of a recrystallization inhibitor. For example, potassium hexacyanoferrate II $K_4Fe(CN)_6$ serves as recrystallization inhibitor. The suspensions obtained by simple precipitation of NaCl through the addition of magnesium chloride can achieve densities up to 1.38 g/cm^3. A further increase in density is possible by addition of a deposited (sedimented) NaCl sludge produced in a similar manner.

The rinse and treatment liquid for deep-hole drilling which contains solid material according to the invention contains precipitated, most finely grained NaCl particles whose grain size distribution can be adapted to the given requirements by controlled

crystallization and recrystallization. The suspension according to the invention always contains a high portion of very fine particles (lying in the range of a few µm) in order to achieve a high sedimentation stability and a dense filter cake which makes possible an effective sealing of the drill hole wall with low costs and which can be broken up by water or unsaturated salt solutions (reblocking).

Exemplary Embodiments

The invention is to be explained in more detail with the aid of two exemplary embodiments.

Exemplary Embodiment 1:

In order to produce one cubic meter of NaCl suspension with a density of 1,380 kg/m^3 the following processing steps are required. Stirring of 400 l of saturated NaCl solution with a concentration of 317 kg/m^3. Addition of 10 to 30 kg of starch soluble in cold water which is completely dissolved by means of intensive stirring in order to obtain the desired viscosity. To achieve as low and uniform a grain spectrum as possible of the precipitating salt, 100 g of recrystallization inhibitor is added. Subsequently the saturation with magnesium chloride up to the desired density takes place, and should in fact take place rapidly and with intensive mixing. For a density of1,380 kg/m^3 1,000 kg of magnesium chloride ($MgCl_2 \cdot 6\ H_20$) are needed.

Exemplary Embodiment 2:

Producing an NaCl suspension with a density of 1,420 kg/m^3. The densities achievable on the basis of th precipitation process is 1,380 kg/m^3. An increase of the density can be achieved by the following processes:

1. A suspension produced according to the process specified in the exemplary embodiment is not moved for a rather long period time so that the rock salt sludge contained can be sedimented off. Liquid 40% by volume free of solid material is separated from this suspension. The density of the remaining suspension is then 1,420 kg/m^3.
2. A separate NaCl suspension is produced according to the process specified in the first exemplary embodiment. The addition of viscosity-increasing polymers is omitted in order to make possible a rapid sedimentation of the precipitated fine rock salt. 60% by volume of the entire solution (liquid free of solid material) is separated after the sedimentation of the rock salt sludge. The remaining salt sludge has a density of 1,470 kg/m^3. By addition of this separately obtained salt sludge in the ratio of 1: 1 to an NaCl suspension of the density 1,380 kg/m^3 an NaCl suspension with a density of 1,420 kg/m^3 results.